AD-A154 774 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS ASHLAND RESERVOIR DAM..(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV AUG 78 1/1

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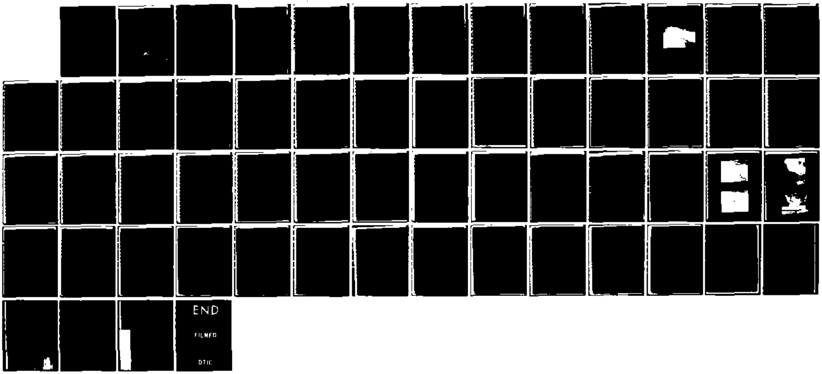

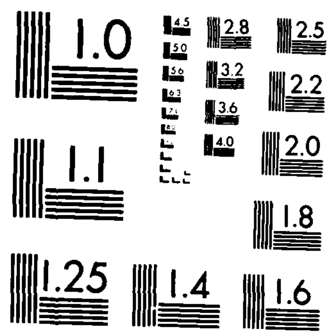

MICROCOPY RESOLUTION TEST CHART
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AD-A154 774

MERRIMACK RIVER BASIN
ASHLAND, MASSACHUSETTS

ASHLAND RESERVOIR DAM

MA 00439

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS 02154

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REPORT DOCUMENTATION PAGE

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18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Merrimack River Basin
Ashland, Massachusetts
Cold Spring Brook

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is a 1500 foot long, 57 foot high embankment structure with a concrete and clay core. This dam was found to be in generally good condition woth no apparent signs of leakage or deterioration. It is intermediate in size and its hazard potential is high. Failure of the dam could cause destruction of dwellings and other property downstream of the dam and would endanger human life.

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
NEDED

Honorable Michael S. Dukakis
Governor of the Commonwealth of
Massachusetts
State House
Boston, Massachusetts 02133

NOV 17 1978

Dear Governor Dukakis:

I am forwarding to you a copy of the Ashland Reservoir Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. In addition, a copy of the report has also been furnished the owner, the Department of Forests and Parks, Commonwealth of Massachusetts, Hopkinton State Park, Route 85, Hopkinton, Massachusetts 01748.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Quality Engineering for your cooperation in carrying out this program.

Sincerely yours,

John P. Chandler

JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

ASHLAND RESERVOIR DAM

MA 00439

MERRIMACK RIVER BASIN
ASHLAND, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification No.:	MA 00439
Name of Dam:	Ashland R. servoir
Town:	Ashland, Massachusetts
County and State:	Middlesex County, Massachusetts
Stream:	Cold Spring Brook
Date of Inspection:	June 12, 1978

BRIEF ASSESSMENT

The Ashland Dam is an 80-year old embankment structure with a concrete and clay core. It is about 1500 feet long at the crest and a height not exceeding 57 feet. Near the right abutment is a granite block cascading spillway 30 feet wide. Freeboard between the spillway crest and the top of the dam is 7 feet. The dam has a drainage area of 3500 acres and impounds a reservoir of 150 acres.

This dam was found to be in generally good condition with no apparent signs of leakage or deterioration. While clogged slightly with growth and debris, the spillway, too, is in good condition. The entire structure appears to be well-engineered and well-constructed and in a surprisingly good state of preservation.

Owing to the impoundment height and storage, Ashland Dam falls within the intermediate size classification. It is in the high hazard potential category and thus hydraulically analyzed using the full probable maximum flood.

Reservoir storage will reduce the maximum probable discharge of 3840 cfs to a test flood of 3450 cfs. The spillway, alone, will pass 1800 cfs (52 percent of the test flood) and, by an overtopping of the embankment of one foot, an additional 3300 cfs can be passed. Thus, the test flood can be passed with the dam overtopped by less than one foot. The Ashland Dam can be considered safe from failure due to overtopping.

A failure of the dam coincident with full spillway discharge, or at any time, could produce a flow approaching 200,000 cfs which would cause destruction of dwellings and other property downstream of the dam and which would endanger human life.

Additional investigations or major modifications are not required. The owner should, however, implement inspection and maintenance procedures, make repairs where necessary, clear the entire spillway channel of growth and debris, reactivate the outlet works, and develop a flood warning system.

Gustav A. Diezemann

Gustav A. Diezemann, P. E.

New York State Lic. 027062

This Phase I Inspection Report on the Ashland Reservoir Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Charles G. Tiersch

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

Fred J. Ravens Jr.

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

Saul Cooper

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

SEP 13 1978

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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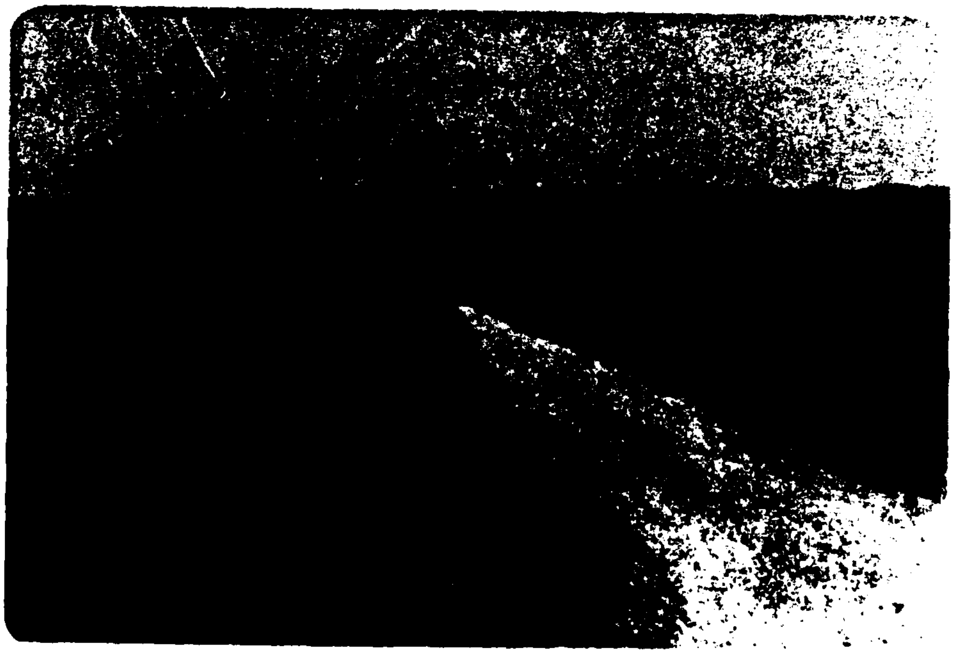
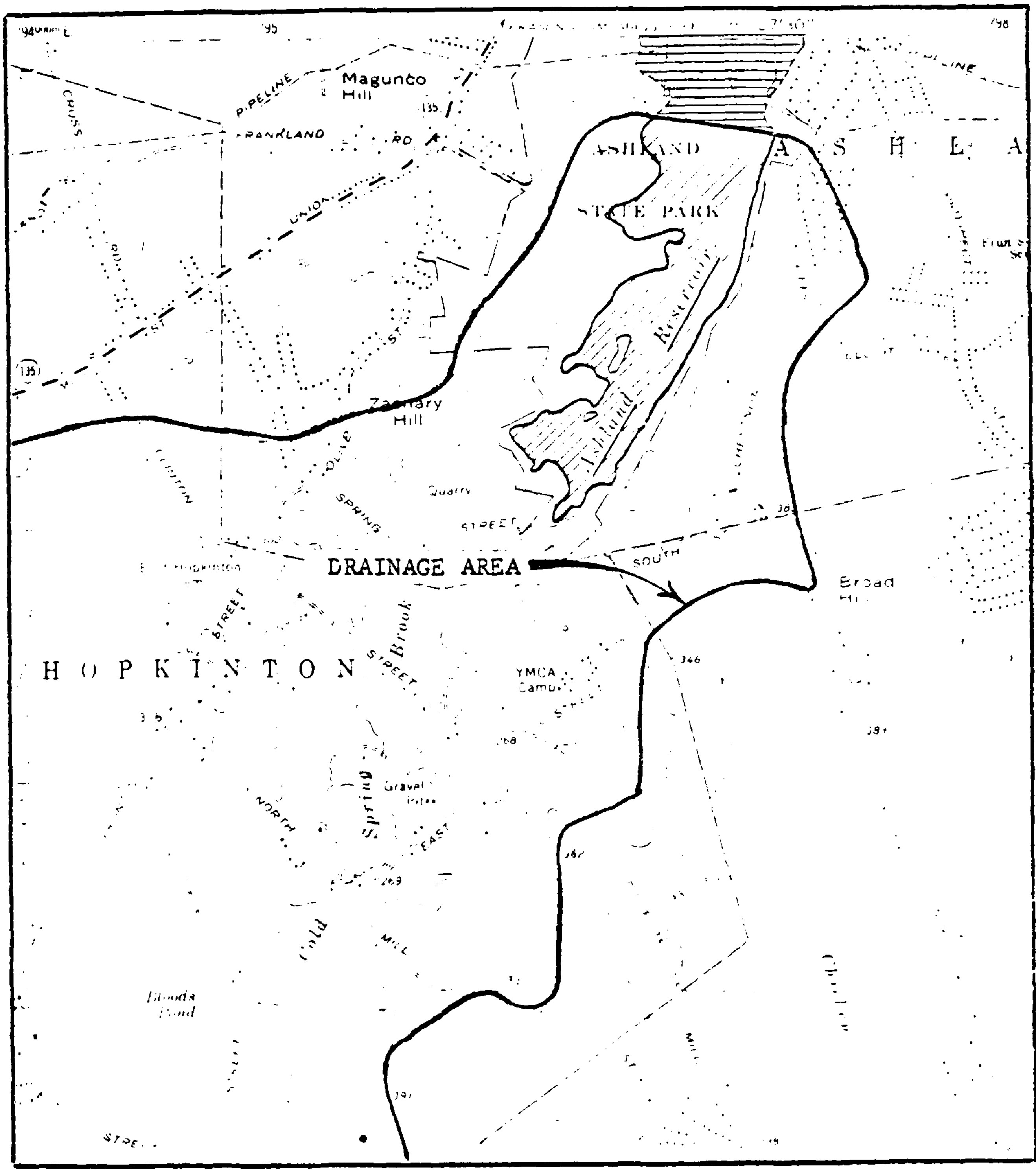


OVERVIEW PHOTO



ASHLAND RESERVOIR

ASHLAND, MASSACHUSETTS

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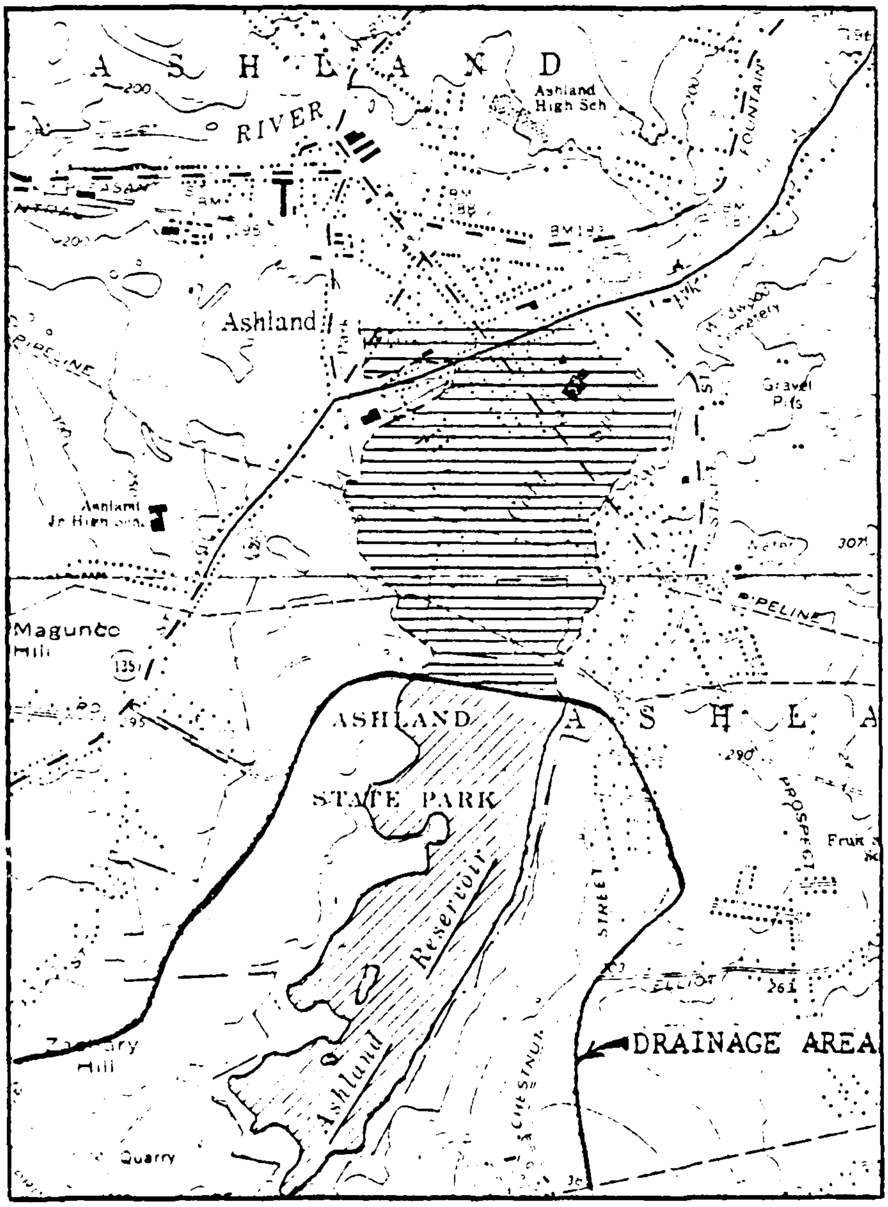

ASHLAND RESERVOIR

ASHLAND, MASSACHUSETTS

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INSPECTION CHECK LIST

PROJECT *Ashland Reservoir* DATE ________

PROJECT FEATURE ________ NAME ________

AREA EVALUATED	CONDITION
DIKE EMBANKMENT	
Crest Elevation	226 ±
Current Pool Elevation	219 ±
Surface Cracks	none
Pavement Condition	good
Movement or Settlement of Crest	none
Lateral Movement	none
Vertical Alignment	O.K.
Horizontal Alignment	O.K.
Condition at Abutment and at Concrete Structures	good
Indications of Movement of Structural Items on Slopes	none
Trespassing on Slopes	some trespassing
Sloughing or Erosion of Slopes or Abutments	none
Rock Slope Protection - Riprap Failures	none
Unusual Movement or Cracking at or near Toes	none
Unusual Embankment or Downstream Seepage	none
Piping or Boils	none
Foundation Drainage Features	...
Toe Drains	—
Instruments ~~on System~~	

2

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Ashland Reservoir

DATE June 12, 1978

TIME 3:00 P.M.

WEATHER Clear / Sunny

W.S. ELEV. 214 U.S. _____ DN.S

PARTY:

1. J Gearlach
2. D. Fischer
3.
4.
5.

PROJECT FEATURE	INSPECTED BY	REMARKS
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

APPENDIX A

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. This 80-year old fill structure appears to be in good condition with no signs of significant distress or deterioration.

b. Adequacy of Information. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and engineering judgment.

c. Urgency. The required repair and maintenance work should be accomplished within two to four years of the receipt of this report by the owner.

d. Need for Additional Investigation. There is no need for additional investigation.

7.2 Recommendations

Additional engineering investigations or major modifications to the dam are not required.

7.3 Operation and Maintenance Procedures

The owner of the dam should develop and implement procedures which would include periodic inspection of the dam for signs of distress, deterioration or vandalism. Repairs and restorations should be made, where required, and the spillway, at least to the end of the constructed channel, should be periodically cleaned of growth and debris.

As a matter of prudence, it should be possible to drain a reservoir of the magnitude of Ashland without breaching the dam. The existing outlet works should be reactivated, the control structure made secure, and the operability of the outlet works periodically tested.

Around the clock surveillance should be provided by the owner during periods of unusually heavy precipitation. The owner should develop a formal warning system with local officials for alerting downstream residents in case of emergency.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. Nothing was noted which would indicate that the dam was unstable.

b. Design and Construction Data. No design or construction data are available other that that shown on the drawings contained herein.

c. Operating Records. Not applicable.

d. Post Construction Changes. No post construction changes are known to have been made.

e. Seismic Stability. This dam is located in Seismic Zone 2 and therefore a seismic analysis is not required according to the recommended guidelines.

capacity - results in a peak failure outflow in excess of 327,000 cfs. While this flow can be mitigated by assuming a lesser breach width and consideration of the storage, any major breach in the dam could result in flows which would endanger property and human life.

There is a wide, deep channel making up reach one below the dam. The water level will reach El. 200 in the case of a breach. There is potential hazard in this reach due to the fact that there are a few homes located on a slight rise in the channel. Reach two water level would be approximately El. 194, which floods a large portion of Ashland. Considering the fact that the area flooded includes a playground and school, the hazard to life is great in a situation of a breach of this magnitude.

The areas of impact immediately downstream of the dam are shown on the location map.

SECTION 5

HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data. The hydraulic/hydrologic analysis was made in accordance with "Preliminary Guidance for Estimating Maximum Probable Discharges in Phase I Dam Safety Investigations", "Estimating Effect of Surcharge Storage on Maximum Probable Discharges", and "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs" as furnished by the New England Division, Corps of Engineers and "Recommended Guidelines for Safety Inspection of Dams" as issued by the Department of the Army, Office of the Chief of Engineers.

U.S.G.S. Quadrangle maps were used to determine reservoir and drainage areas. Where practicable, spillway dimensions were obtained by direct measurement. Hydraulic coefficients were assigned on the basis of experience and engineering judgment.

b. Experience Data. No specific experience data with respect to the hydraulic/hydrological characteristics of the project are known to exist.

c. Visual Observations. The spillway is in good structural condition, the growth and debris in it not being a serious impediment to the safe discharge of low flows. Overtopping would not significantly spread to either side of the dam, the effective discharge length being about equal to the length of the dam.

d. Overtopping Potential. A Probable Maximum Flood (PMF) of 3,840 cfs was determined. Owing to high hazard potential and intermediate size classification, the PMF was used in the determination of the Peak Outflow (or test flood) of 3,450 cfs. Computational methods, not considering discharge during the storm periods nor the additional reservoir storage available along the banks of the reservoir, indicate that the test flood can be discharged with less than one foot of overtopping of the embankment. Consideration of these effects would reduce the height of overtopping, if not eliminating it completely.

The channel downstream of the dam could probably carry the test flood to the next reservoir without necessarily endangering human life. However, there probably would be some flooding and damage to the low-lying houses and other structures. The U.S.G.S. quad sheets do not permit an accurate analysis.

The application of "rule of thumb" procedures for the estimation of the downstream dam failure hydrograph - with the assumption of a maximum breach width of 30 percent of the dam combined with the spillway

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedures

Other than letting the reservoir discharge over the fixed crest spillway, there are no operating procedures.

4.2 Maintenance of Dam

There are apparently no maintenance procedures in effect. There is considerable vegetation and growth at the foot of the downstream dam face.

4.3 Maintenance of Operating Facilities

The operating facilities at the gate house have been closed and abandoned.

4.4 Warning System

There is no warning system.

4.5 Evaluation

There appears to be a complete lack of operational procedures. Recommendations for improving these conditions are given in Section 7.3.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The project, considering its advanced age of over 80 years, appears to have been well conceived, designed, constructed and, in general, maintained.

b. Dam. The dam appears to be in good condition with considerable forest growth and vegetation at the foot of the downstream face. There are no signs of significant misalignment, leakage, distress or deterioration.

c. Appurtenant Structures. The cascading spillway is constructed of granite blocks. While there is some vegetation in the joints and general reservoir debris in the channel, the spillway appears to be in good condition and capable of conveying water in the manner intended. The gatehouse has been abandoned and is in almost complete disrepair.

d. Reservoir Area. The banks surrounding the reservoir are generally flat and wooded. There are no houses along the perimeter of the reservoir.

e. Downstream Channel. Immediately downstream of the dam is a relatively flat, heavily-wooded marsh with several houses along its outer edges and on a spit of higher ground extending downstream into the marsh. For the first 2,000 ft. downstream of the dam, the marsh is about as broad as the dam. Downstream of the wooded marsh, the town of Ashland lies on somewhat higher ground, jutting into the marsh roughly perpendicular to the river channel. At this point the actual channel is quite narrow and the town lies on the left bank flood plain. Downstream of the town, Cold Stream Brook joins the Sudbury River.

3.2 Evaluation

Visual inspection of earthfill structures does not necessarily provide a good insight as to their physical condition. In the case of the Ashland Dam, however, the generally good findings of the visual inspection seem to corroborate its apparently trouble-free operating record.

SECTION 2

ENGINEERING DATA

2.1 Design

There are drawings available showing the dam cross section, a section through the intake, the spillway cross section, and a general plan of the dam. These drawings are reproduced in this report. The originals of these drawings are in the offices of the Department of Environmental Management located at 100 Cambridge Street in Boston, Massachusetts. Other than these drawings, there are no design data or records available.

2.2 Construction

The Ashland Dam was built around 1900. There are no detailed construction records available.

2.3 Operation

There is no formal operation of the dam. The fixed spillway crest controls the water level of the reservoir, and no operating records are kept.

2.4 Evaluation

a. Availability. Other than the drawings listed above, there are no engineering data available.

b. Adequacy. The lack of in-depth engineering data does not allow for a definitive review. Therefore, the adequacy of this dam, structurally and hydraulically, cannot be assessed from the standpoint of review of design calculations, but must be based primarily on the visual inspection, past performance history, and sound hydrologic and hydraulic engineering judgment.

c. Validity. The limited data available do not furnish a proper basis for a detailed evaluation of this dam.

g. Dam

(1)	Type	Earthfill with concrete core
(2)	Length	1,500 ± feet
(3)	Height	57 feet
(4)	Top Width	20 feet
(5)	Side slope	2H:1V Upstream. 2H:1V & 2½ H:1V Downstream
(6)	Zoning	See drawing
(7)	Impervious core	Concrete and clay
(8)	Cutoff	None
(9)	Grout curtain	Unknown
(10)	Other	N/A

h. Spillway

(1)	Type	Ungated
(2)	Length of weir	30 feet
(3)	Crest elevation	El. 219 ±
(4)	Gates	None
(5)	U/S Channel	N/A
(6)	D/S Channel	Cascading granite block spillway
(7)	General	N/A

i. Regulating Outlets. There is a 48-inch concrete conduit through the dam at approximately El. 170. The slide gate, formerly controlled from the gate house on the dam, has been permanently closed.

c. <u>Elevation</u> (Feet Above MSL)

(1) Top of dam — El. 226 ±

(2) Maximum design surcharge — El. 226 ±

(3) Full flood control pool — N/A

(4) Recreation pool — El. 219 ±

(5) Spillway crest (gated) — El. 219 ± (ungated)

(6) Upstream portal invert diversion tunnel — N/A

(7) Streambed at centerline of dam — El. 169 ±

(8) Maximum tailwater — Impossible to ascertain accurately

d. <u>Reservoir</u> (Feet)

(1) Length of maximum pool — 7,000 ±

(2) Length of recreation pool — 6,000 ±

(3) Length of flood control pool — N/A

e. <u>Storage</u> (Acre-Feet)

(1) Recreation pool — 3,800 ±

(2) Flood control pool — N/A

(3) Design surcharge — 4,900 ±

(4) Top of dam — 4,900 ±

f. <u>Reservoir Surface</u> (Acres)

(1) Top of dam — 325

(2) Maximum pool — 325

(3) Flood control pool — N/A

(4) Recreation pool — 150 ±

(5) Spillway crest — 150 ±

c. Size Classification. Owing to its height of 57 feet and its impoundment of roughly 3800 acre feet below the crest, the dam falls within the intermediate size classification.

d. Hazard Classification. As there are many houses and other structures downstream of the dam which would be endangered if the dam failed, the dam is considered to have a high hazard potential.

e. Ownership. The dam is owned by the Department of Forests and Parks of the Commonwealth of Massachusetts. It was owned formerly by the City of Boston.

f. Operator. Mr. John Pielczarski
Hopkinton State Park, Route 85
Hopkinton, Massachusetts
Office: (617) 435-4303; Home: (617) 943-3776

g. Purpose of Dam. The reservoir impounded by the dam is presently used for recreation purposes. It was formerly part of the water supply system of the City of Boston.

h. Design and Construction History. Other than a drawing, excerpts from which are part of this report, nothing is known of the design and construction history of this project. It was constructed in 1898.

i. Normal Operating Procedures. As the sluices have been permanently closed, there are no operating procedures other than to let water discharge over the ungated spillway.

1.3 Pertinent Data

a. Drainage Area. The Ashland Reservoir has approximately 5.48 square miles of drainage area of essentially flat, semi-forested rural land.

b. Discharge at Damsite.

(1) The presently closed outlet works consist of sluices formerly controlled by 48" slide gates operated from a stone and brick gate house on the crest of the dam. The gate house is now partially destroyed and the gate hoist mechanism inoperable.

(2) The maximum known flood at the damsite is unknown.

(3) The ungated spillway capacity before the dam is overtopped is about 1,800 cfs or approximately 52 percent of the test flood.

(4) There is no gated spillway capacity.

(5) There is no gated spillway capacity.

(6) The total spillway capacity at maximum pool elevation is 1800 cfs at El. 226 ±.

PHASE I INSPECTION REPORT

ASHLAND DAM AND RESERVOIR

SECTION I

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Chas. T. Main, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed were issued to Chas. T. Main, Inc. under a letter of May 3, 1978, from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-D328 has been assigned by the Corps of Engineers for this work.

b. Purpose.

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) Encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. The Ashland Dam and Reservoir on Cold Stream Brook are located in the Town of Ashland, Middlesex County, Massachusetts.

b. Description of Dam and Appurtenances. The dam is an earthfill structure with concrete core about 1500 feet long and about 57 feet high at maximum section. The cascading spillway is constructed of granite blocks and is 30 feet wide.

INSPECTION CHECK LIST

PROJECT *Ashland Reservoir* DATE ________

PROJECT FEATURE ________ NAME ________

AREA EVALUATED	CONDITION
CONCRETE DAM	
Concrete Surfaces	
Structural Cracking	
Movement -- Horizontal & Vertical Alignment	
Junctions	
Drains -- Foundation, Joint, Face	
Water Passages	APPLICABLE
Seepage or Leakage	
Monolith Joints -- Construction Joints	
Foundation	

INSPECTION CHECK LIST

PROJECT Ashland Reservoir DATE

PROJECT FEATURE NAME

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE</u>	
a. Approach Channel	
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	NOT
Debris	APPLICABLE
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	
Condition of Concrete	
Stop Logs and Slots	

INSPECTION CHECK LIST

PROJECT *ASHLAND RESERVOIR* DATE ______

PROJECT FEATURE ______ NAME ______

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	NOT APPLICABLE
Alignment of Joints	
Numbering of Monoliths	

INSPECTION CHECK LIST

PROJECT *ASHLAND RESERVOIR* DATE ____________________

PROJECT FEATURE ____________________ NAME ____________________

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	[illegible]
Loose Rock Overhanging Channel	[illegible]
Trees Overhanging Channel	[illegible]
Floor of Approach Channel	
b. Weir and Training Walls	
General Condition of Concrete	[illegible]
Rust or Staining	[illegible]
Spalling	[illegible]
Any Visible Reinforcing	[illegible]
Any Seepage or Efflorescence	[illegible]
Drain Holes	[illegible]
c. Discharge Channel	
General Condition	[illegible]
Loose Rock Overhanging Channel	[illegible]
Trees Overhanging Channel	[illegible]
Floor of Channel	[illegible]
Other Obstructions	

INSPECTION CHECK LIST

PROJECT *ASHLAND RESERVOIR* DATE ______________

PROJECT FEATURE ______________ NAME ______________

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	
General Condition	
Condition of Joints	
Spalling	
Visible Reinforcing	
Rusting or Staining of Concrete	
Any Seepage or Efflorescence	*NOT*
Joint Alignment	[illegible]
Unusual Seepage or Leaks in Gate Chamber	
Cracks	
Rusting or Corrosion of Steel	
b. Mechanical and Electrical	
Air Vents	
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System	

INSPECTION CHECK LIST

PROJECT ASHLAND RESERVOIR DATE

PROJECT FEATURE NAME

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u>	
General Condition of Concrete	
Rust or Staining	
Spalling	
Erosion or Cavitation	
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain holes	
Channel	[illegible]
Loose Rock or Trees Overhanging Channel	
Condition of Discharge Channel	

INSPECTION CHECK LIST

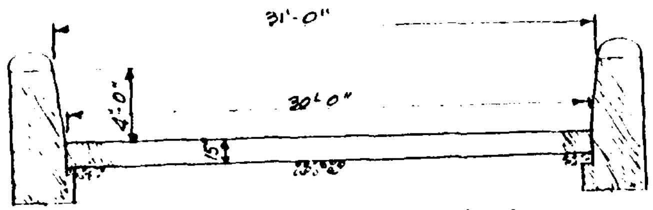
PROJECT *ASHLAND RESERVOIR* DATE

PROJECT FEATURE NAME

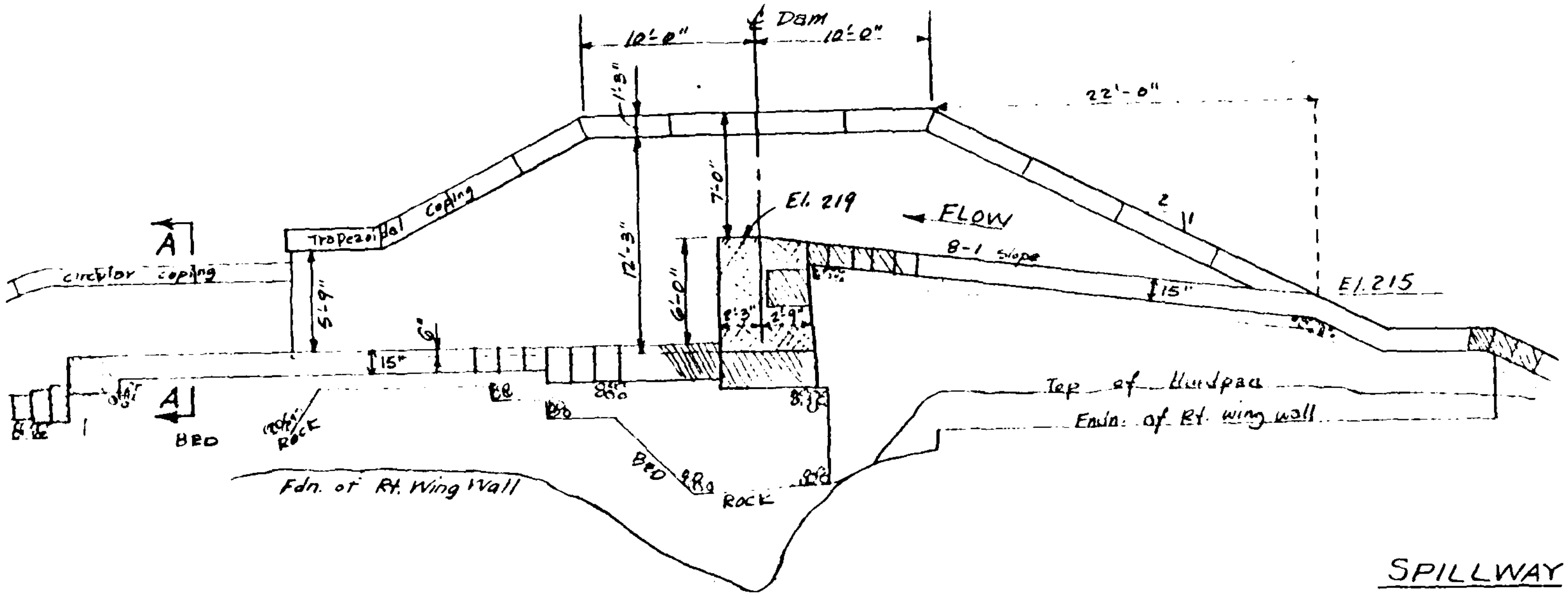
AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	
a. Super Structure	
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Under Side of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutment & Piers	
General Condition of Concrete	
Alignment of Abutment	
Approach to Bridge	
Condition of Seat & Backwall	

APPENDIX B

A few drawings were available at the Bureau of Environmental Management located at 100 Cambridge Street, Boston, Massachusetts. Excerpts from these drawings follow.



SECTION A-A
Not to Scale

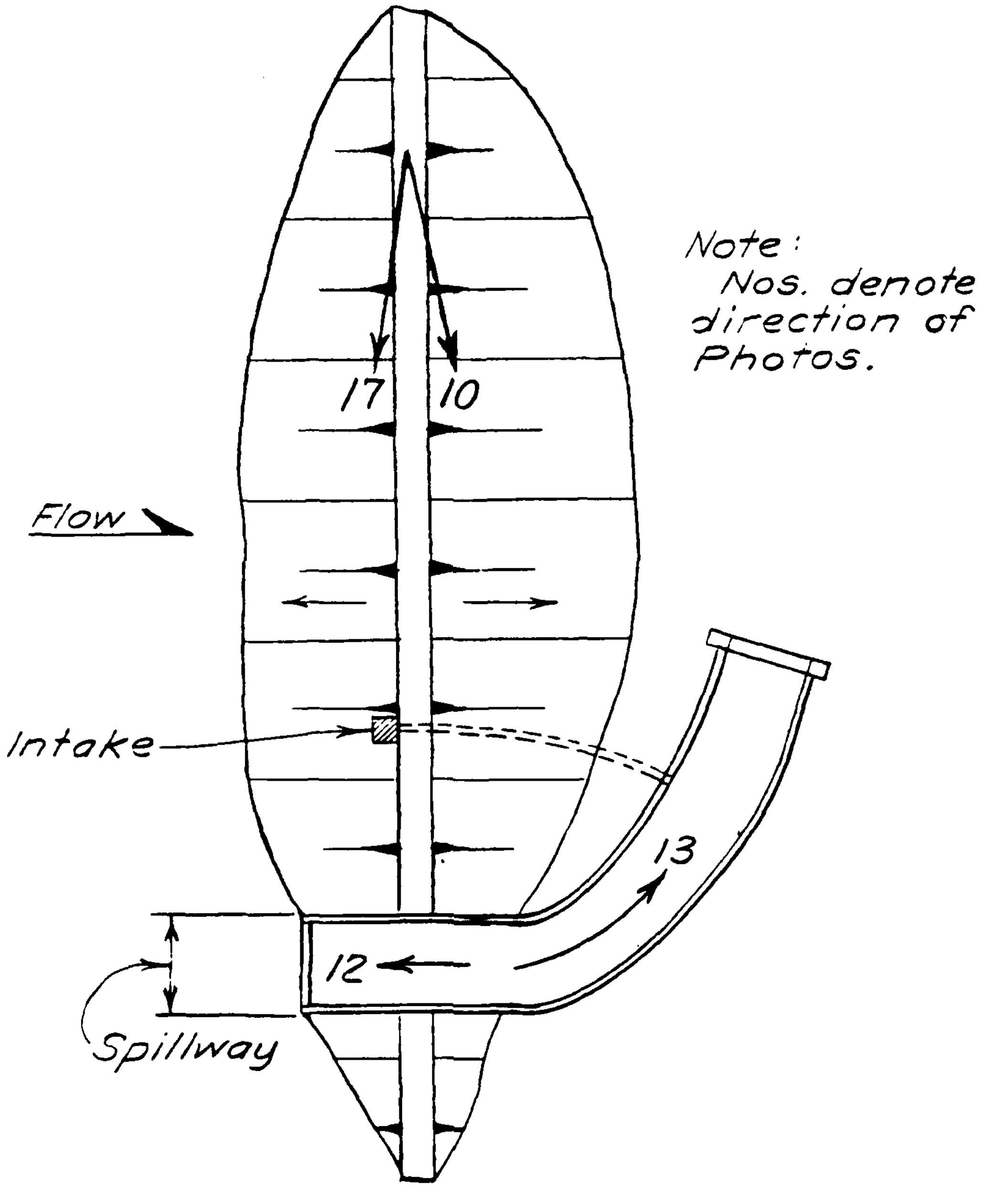


SECTION THRU SPILLWAY
Not to Scale

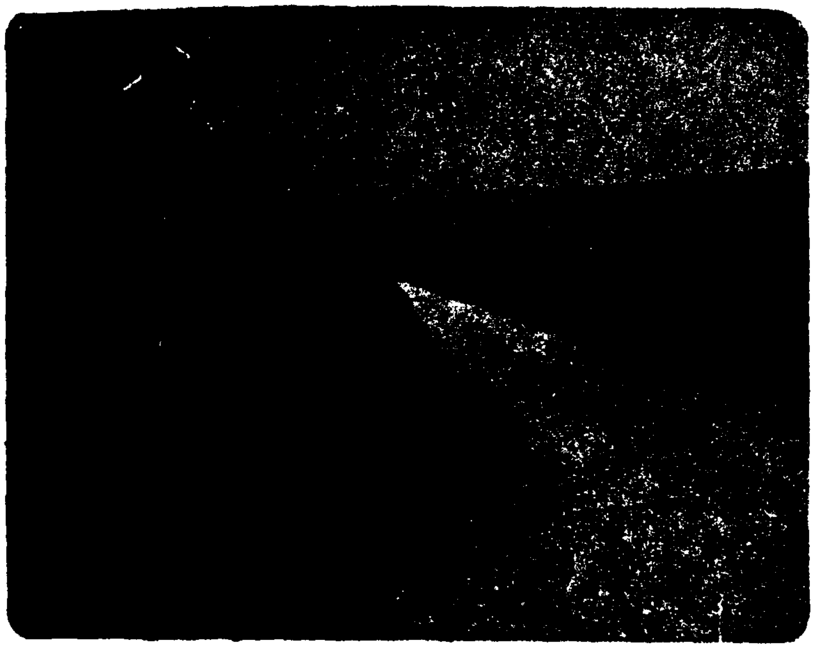
SPILLWAY SEC

ASHLAND RE

APPENDIX C



PLAN
ASHLAND RESERVOIR



10

Downstream View of Embankment

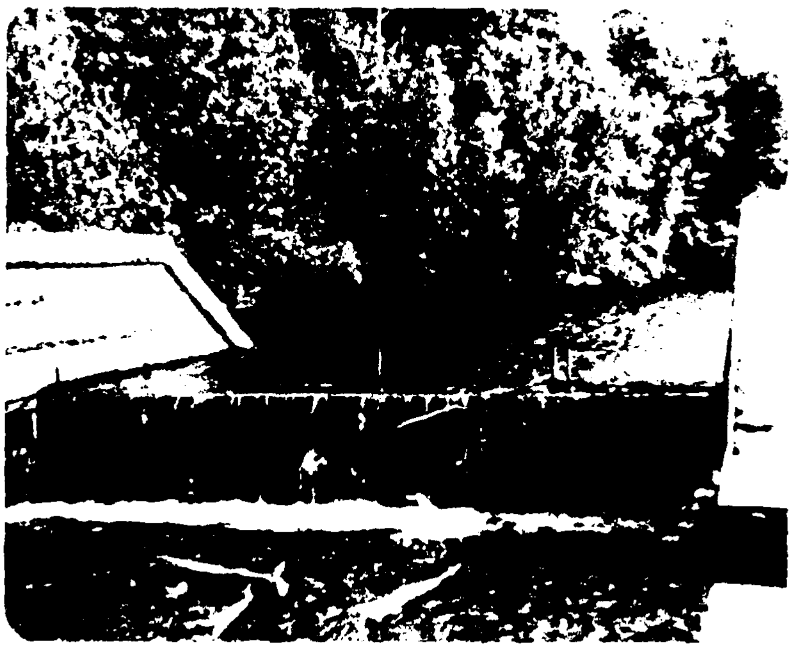
17

Upstream View of Embankment

ASHLAND RESERVOIR

13

Downstream View of Spillway Channel

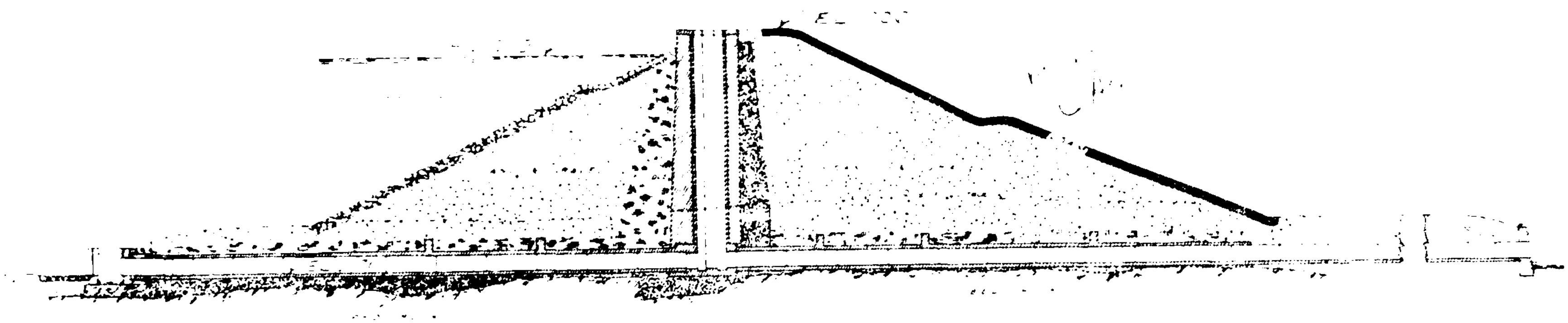


12

Downstream View of Spillway

ASHLAND RESERVOIR

REPRODUCED AT GOVERNMENT EXPENSE



SECTION OF DAM AT 48 INCH OUTLET

SECTION THRU INTAKE

ASHLAND RESERVOIR

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR DIST	STATE	COUNTY	CONGR DIST	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY MO YR
MA	439	NED	MA	017	03				ASHLAND RESERVOIR DAM	4215.0	7127.5	08SEP78

POPULAR NAME	NAME OF IMPOUNDMENT
	ASHLAND RESERVOIR

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	06	COLD SPRING BROOK	ASHLAND	6	9000

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUC HEIGHT (FT.)	HYDRAU HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)	DIST	OWN	FED	R	PRV/FED	SCS	A	VER/DATE
RECTPG	1695	R	57	50	4275	3750	NED	N	N		N	N		31AUG78

REMARKS

D/S HAS	SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
1	1500	U	30	1800	234000											

OWNER	ENGINEERING BY	CONSTRUCTION BY
DEPT OF FORESTS + PARKS		

REGULATORY AGENCY DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE DAY MO YR	AUTHORITY FOR INSPECTION
CHAS.T.MAIN,INC	12JUN78	PL92-367

REMARKS

APPENDIX E

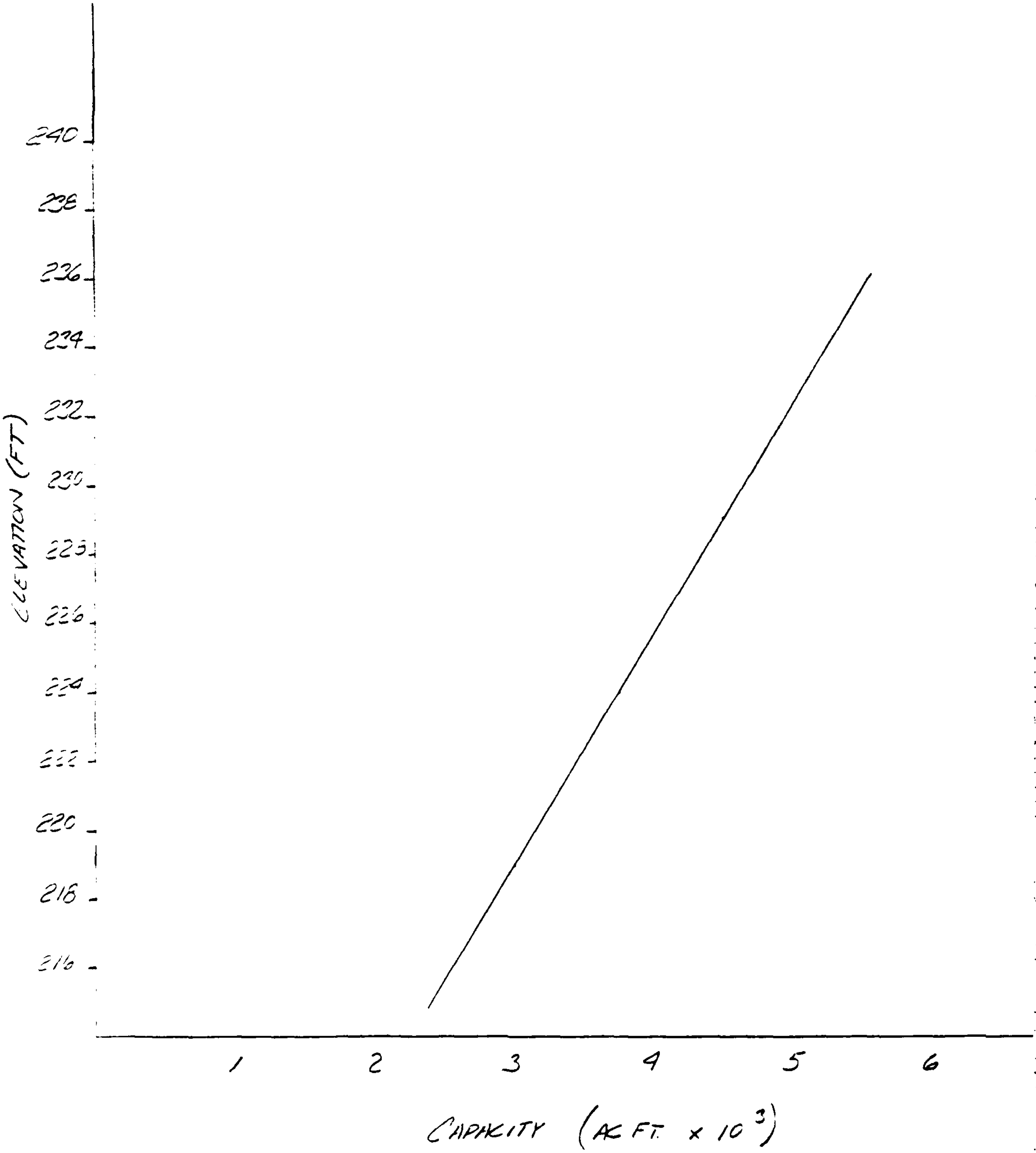
INFORMATION AS CONTAINED IN

THE NATIONAL INVENTORY OF DAMS

Client C OF E Job No. Sheet of

Subject - ASHLAND - By J. VEITCH Date

CAPACITY CURVE Ckd. Rev.



Client COE Job No. ____ Sheet 8 of ____
Subject ASHLAND RES By J VEITCH Date 18 JULY 1978
Ckd. ____ Rev. ____

REACH ②

EL. 180 $Q = 1938 (30)\left(\frac{1938}{1570}\right)^{2/3}(.002)^{1/2} = 2,990$ CFS

185 $Q = 11163 (30)\left(\frac{11163}{2173}\right)^{2/3}(.002)^{1/2} = 44,590$ CFS

190 $Q = 23723(30)\left(\frac{23723}{2775}\right)^{2/3}(.002)^{1/2} = 133,125$ CFS

195 $Q = 38598 (30)\left(\frac{38598}{3338}\right)^{2/3}(.002)^{1/2} = 275,910$ CFS

200 $Q = 55004(30)\left(\frac{55004}{3475}\right)^{2/3}(.002)^{1/2} = 469,520$ cfs

CRITICAL CASE PFD. Q = 327400

REACH I Q = 327,900 EL. 199.5'

HOMES on high ground, MID CHANNEL FLOODED. HIGH HAZARD to life & property.

II Q = 236,570 EL. 193.8'

EXCESSIVE flooding to ASHLAND. HAZARD to life significant.

CASE II TEST FLOOD 3450 cfs.

REACH I EL. 180.5' only slight possibility of flooding.

II EL ≤ 180. slight flooding to homes on Main St, assuming culvert plugged & flow backing up to street. el. No hazard to life.

Client C of E — Job No. — Sheet 7A of
Subject Ashland Res — By J. Veitch — Date 28 Aug. 1978
Ckd. — Rev.

REACH I. $Q = 327,400$ cfs P.F.O EL. = 199.5

$V_1 = \frac{19.5}{20}\frac{(39025)\,1500}{43560} = 1310$ AC FT $S = 4275$ AC FT ✓

Q_{P2} (TRIAL) $= 327,400\left(1 - \frac{1310}{4275}\right) = 227,075$ cfs

$V_2 = \frac{15.8}{19.5}(1310) = 1061$ AC FT $V_{AVE} = 1186$ AC FT

$Q_{P2} = 327,400\left(1 - \frac{1186}{4275}\right) = 236,570$ cfs $= Q_{P1}$ REACH II

REACH II. $Q_{P1} = 236,570$ cfs EL = 193.8

$V_1 = \frac{18.8}{20}\frac{(38598)(1500)}{43560} = 1249$ AC FT

Q_{P2} (TRIAL) $= 236570\left(1 - \frac{1249}{4275}\right) = 167,453$ cfs

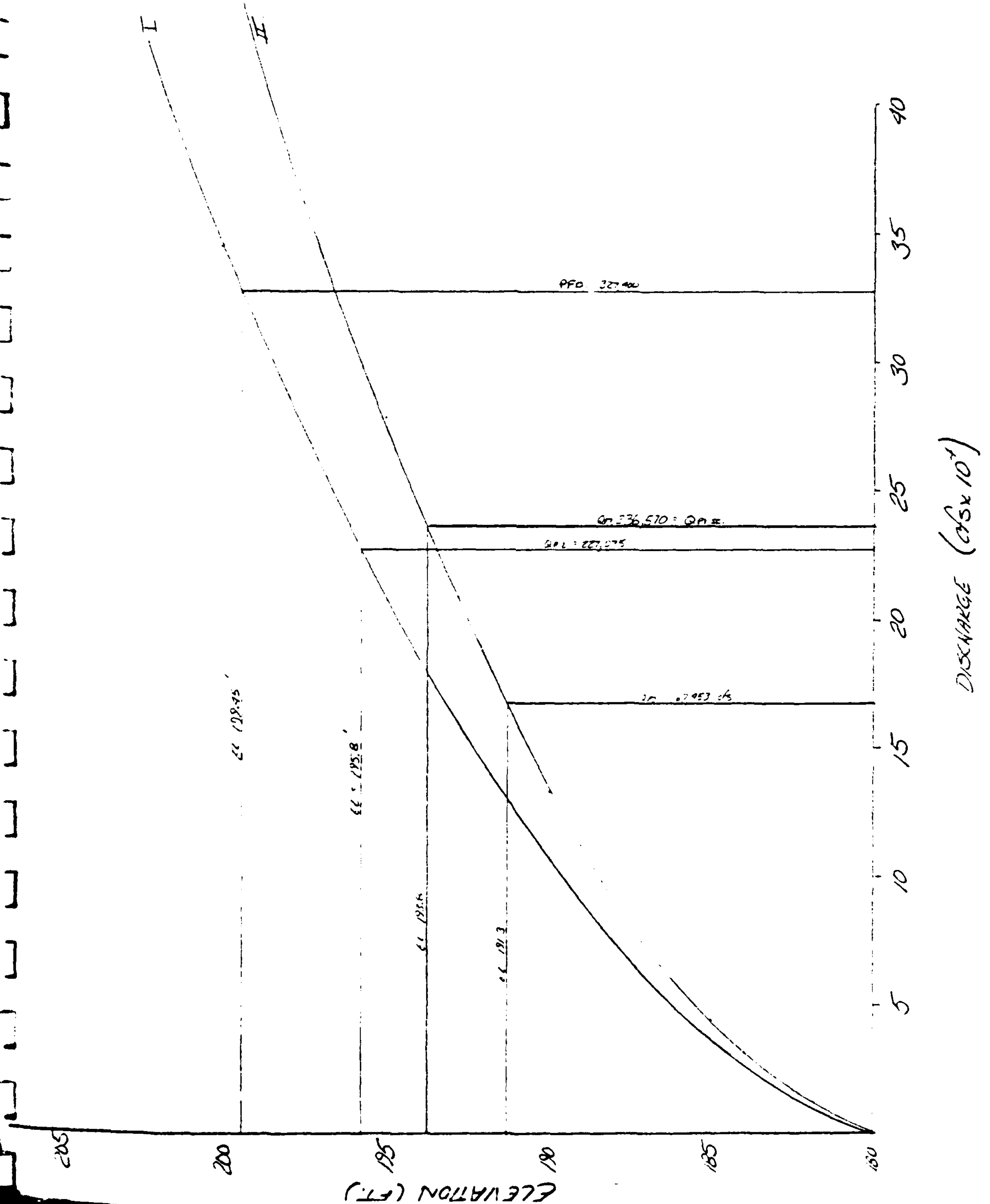
$V_2 = \frac{16.3}{18.8}(1249) = 1083$ AC FT $V_{AVE} = 1166$ AC FT

$Q_{P3} = 236,570\left(1 - \frac{1166}{4275}\right) = 172,046$ cfs

Client C of E Job No. ______ Sheet 7 of ______

Subject ASHLAND By C. VEITCH Date 28 AUG 1978

CHANNEL RATING CURVES Ckd. ______ Rev. ______



Client C of E | Job No. | Sheet 6 of

Subject Ashland Res | By J. Veitch | Date 17 July 1979

Ckd. | Rev.

Area, Wetted P. calc

	el.	A. (ft^2)	Σ A	W.P. (ft)	Σ W.P.
Section One:	180	325	325	900	900
	185	4910	5235	150	1050
	190	5730	10965	150	1200
	195	6670	17635	285	1485
	200	8138	25773		1770
Section Two:	180	2475	2475	2020	2020
	185	10100	12575	305	2325
	190	12190	24765	365	2550
	195	13325	38090	225	2775
	200	14188	52278		2900
Section Three:	180	1400	1400	1120	1120
	185	8350	9750	940	2060
	190	12940	22690	940	3000
	195	16415	39105	400	3400
	200	18625	57730		4050

Stage Rating

Reach 1 — Using ave areas & W.P. $S = .002$ $n = .05$ $C = 30$

El. 180 $Q = ACR^{2/3}S^{1/2} = 1400(30)\left(\frac{1400}{1460}\right)^{2/3}(.002)^{1/2} = 1830$ cfs

185 $Q = 2905(30)\left(\frac{2905}{1663}\right)^{2/3}(.002)^{1/2} = 36,500$ cfs

190 $Q = 17865(30)\left(\frac{17865}{1875}\right)^{2/3}(.002)^{1/2} = 107,725$ cfs

195 $Q = 27863(30)\left(\frac{27863}{2130}\right)^{2/3}(.002)^{1/2} = 207,540$ cfs

200 $Q = 39025(30)\left(\frac{39025}{2335}\right)^{2/3}(.002)^{1/2} = 345,483$ cfs

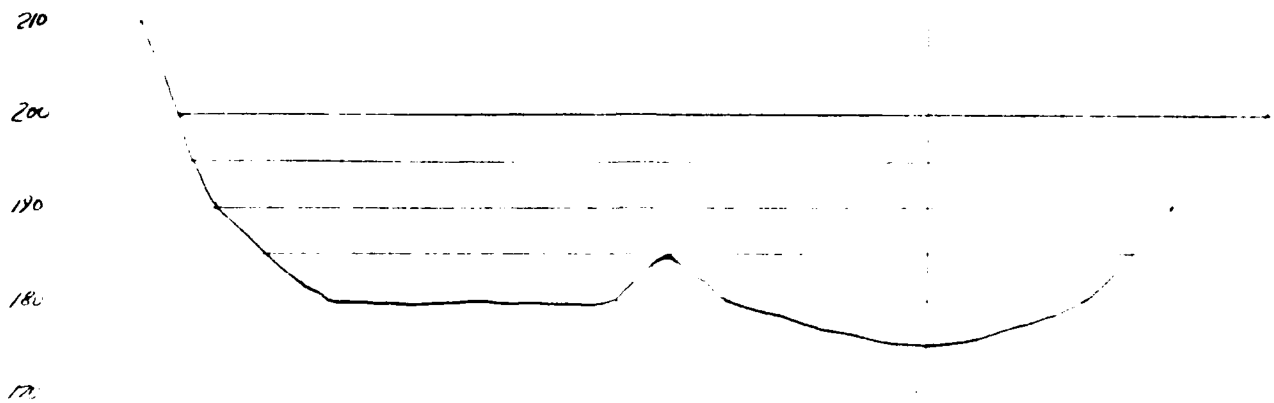
Client C of E   Job No. ____   Sheet 5 of ____

Subject ASHLAND RES   By J. YEITCH   Date 12 JULY 1978

Ckd. ____   Rev. ____

SECTION TWO

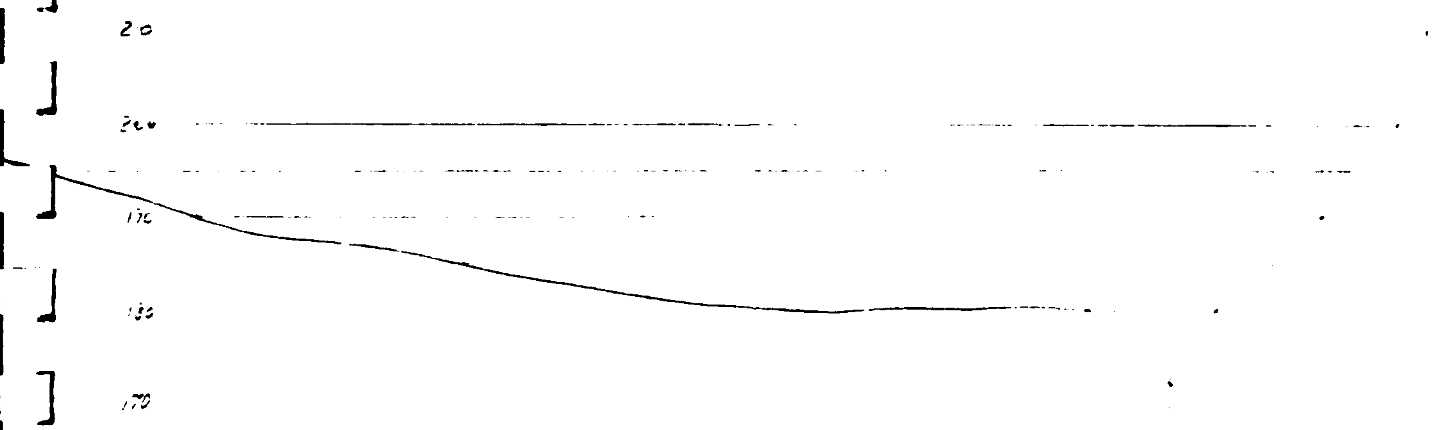
1500' below DAM



1" = 500' →

SECTION THREE   C.D.

3000' below DAM



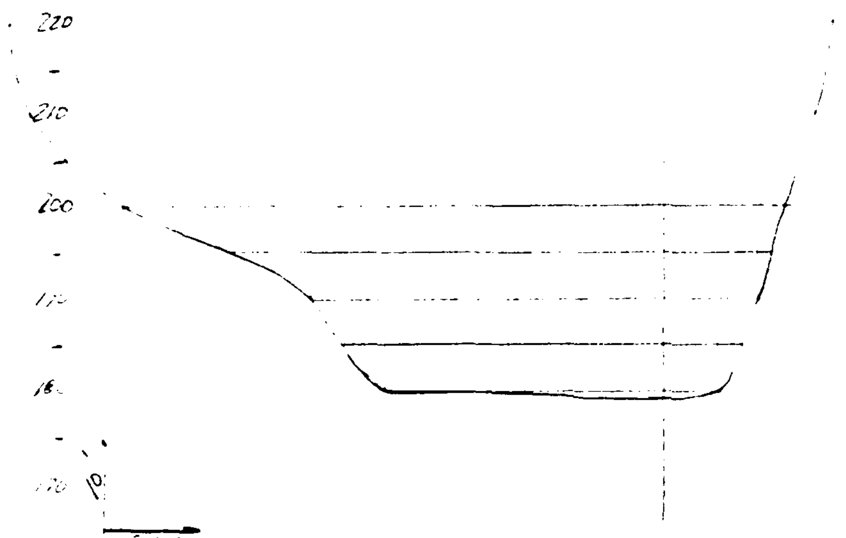
Client C of E   Job No. ______   Sheet 1 of ______
Subject ASHLAND RES   By J VEITCH   Date [illegible]
Ckd. ______   Rev. ______

USING USGS QUAD SHEETS:

REACH #1.

SLOPE = $\frac{\;\;}{3000'}$ = .002   n = .05   C = 30

L.D.



HORIZONTAL SCALE: 1" = 500'

SECTION ONE JUST below DAM.

Client C.E. Job No. ______ Sheet 3 of ______

Subject Lehany By ______ Date ______

Ckd. ______ Rev. ______

STORAGE IN RESERVOIR

Surface area = 150 acres

depth at dam = 57 assume K = .5

S = 150 × 57 × 0.5 = 4275 AF

PEAK FAILURE OUTFLOW (Q_P)

$Q_P = 8/27 \, W_b \sqrt{g} \, y_0^{3/2}$ $y_0 = 57'$

ASSUME 30% .3(1500) = 450

$Q_P = 8/27 (450)(\sqrt{32.2})(57)^{1.5}$

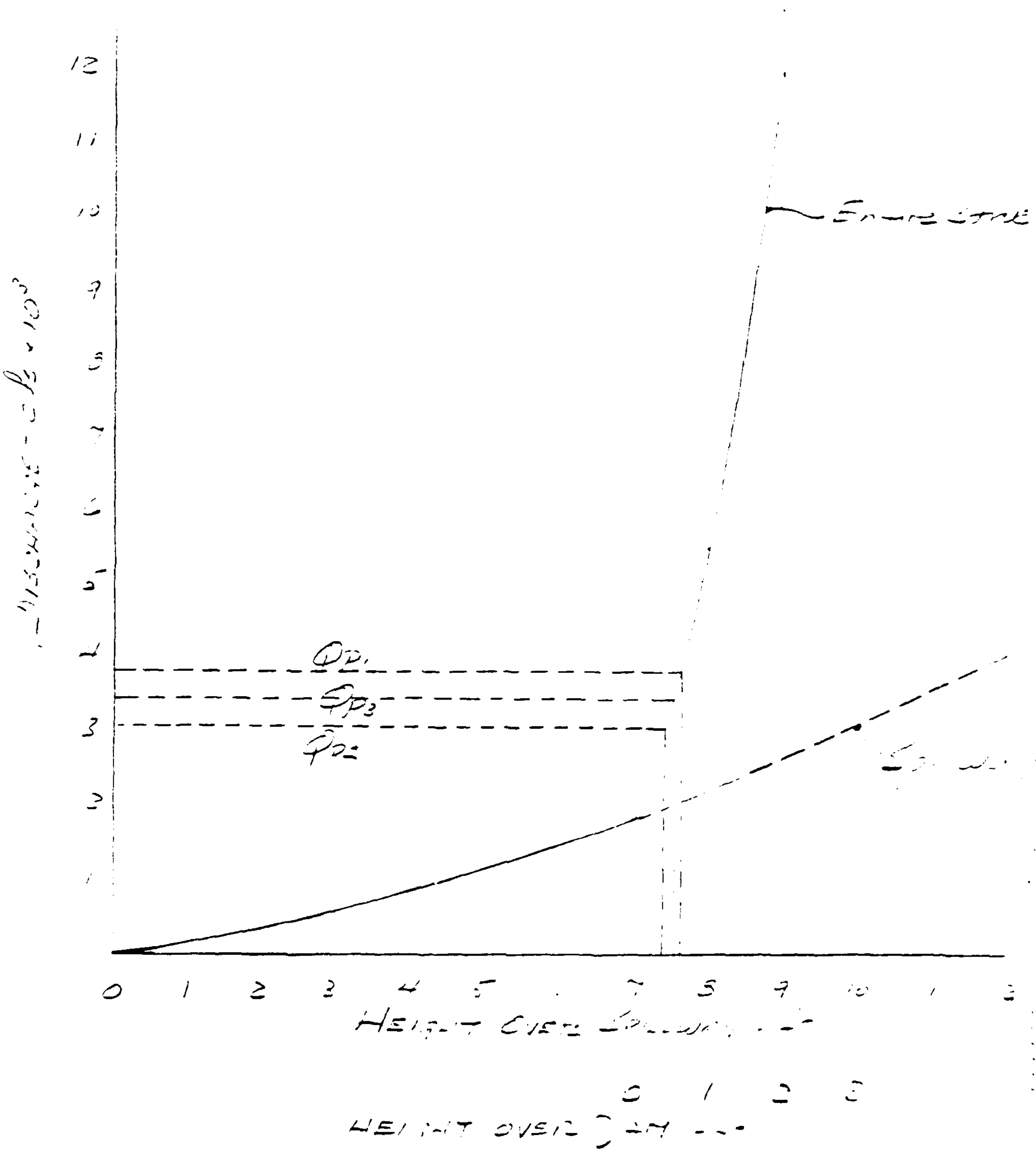
= 325,600 CFS. + 1800 cfs

= 327,400 cfs (BREACH + SPILLWAY CAPACITY)

Client _______________ Job No. _______ Sheet 2 of ____

Subject ____ Ashland ____ By _______ Date _______

Ckd. _______ Rev _______



Client C & E | Job No. | Sheet 1 of
Subject Adhan | By | Date
| Ckd. | Rev.

PMF = 3,640 cfs = Qp1 — Hazard Class. — High/Int.
Reservoir Area: 150 acres
Drainage Area 5.5 mi² = 3,520 acres
Spillway 30' C = 3.25
7' deep
Length of dam 1,500' C = 2.25

Surcharge ht to pass Qp1 (see curve) = 7.7'

$STOR_1 = \frac{150 \times 7.7}{3{,}520} \times 12 = 3.94''$

$Qp_2 = Qp_1 (1 - STOR_1/19) = 3{,}640 (1 - .207) = 3{,}045$ cfs

From curve, surcharge to pass Qp_2 = 7.4'

$STOR_2 = \frac{150 \times 7.4}{3{,}520} \times 12 = 3.78''$

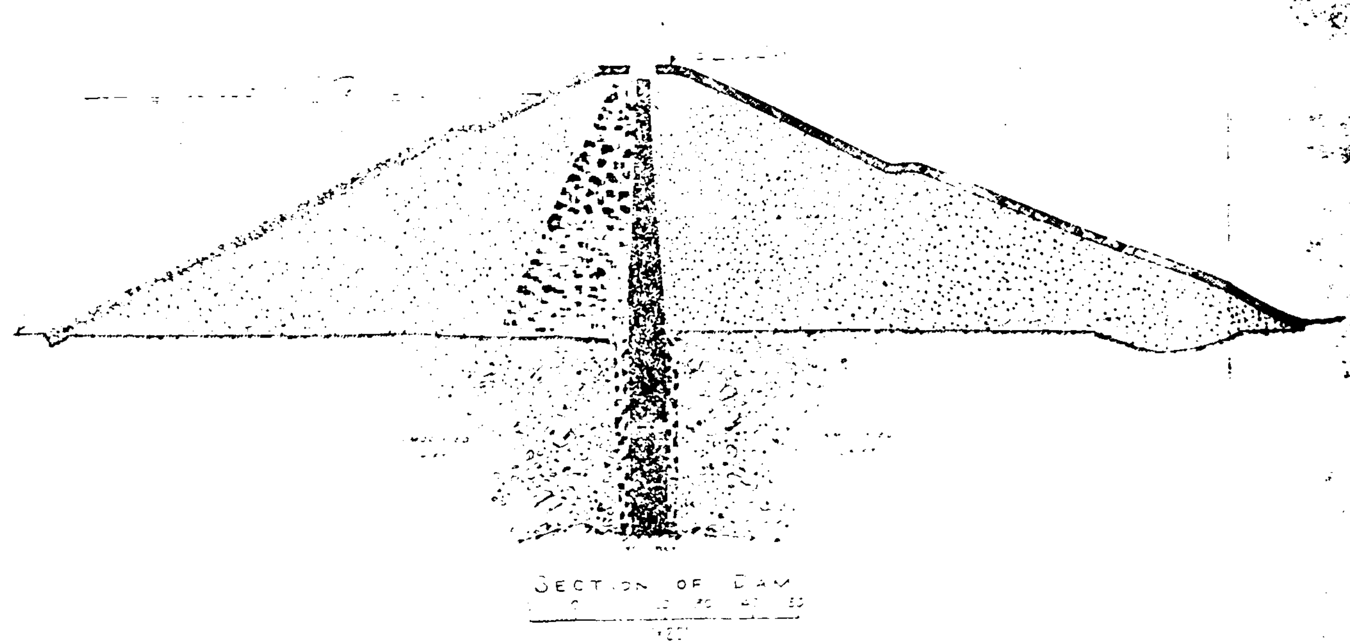
Aver STOR − $STOR_2$ = 3.86''

Aver surcharge = $\frac{3.86 \times 3{,}520}{150 \times 12}$ = 7.55'

Qp_3 = 3,450 cfs

∴ Structure will pass PMF (Qp3) without exceeding 1' overtopping; ... of dam.

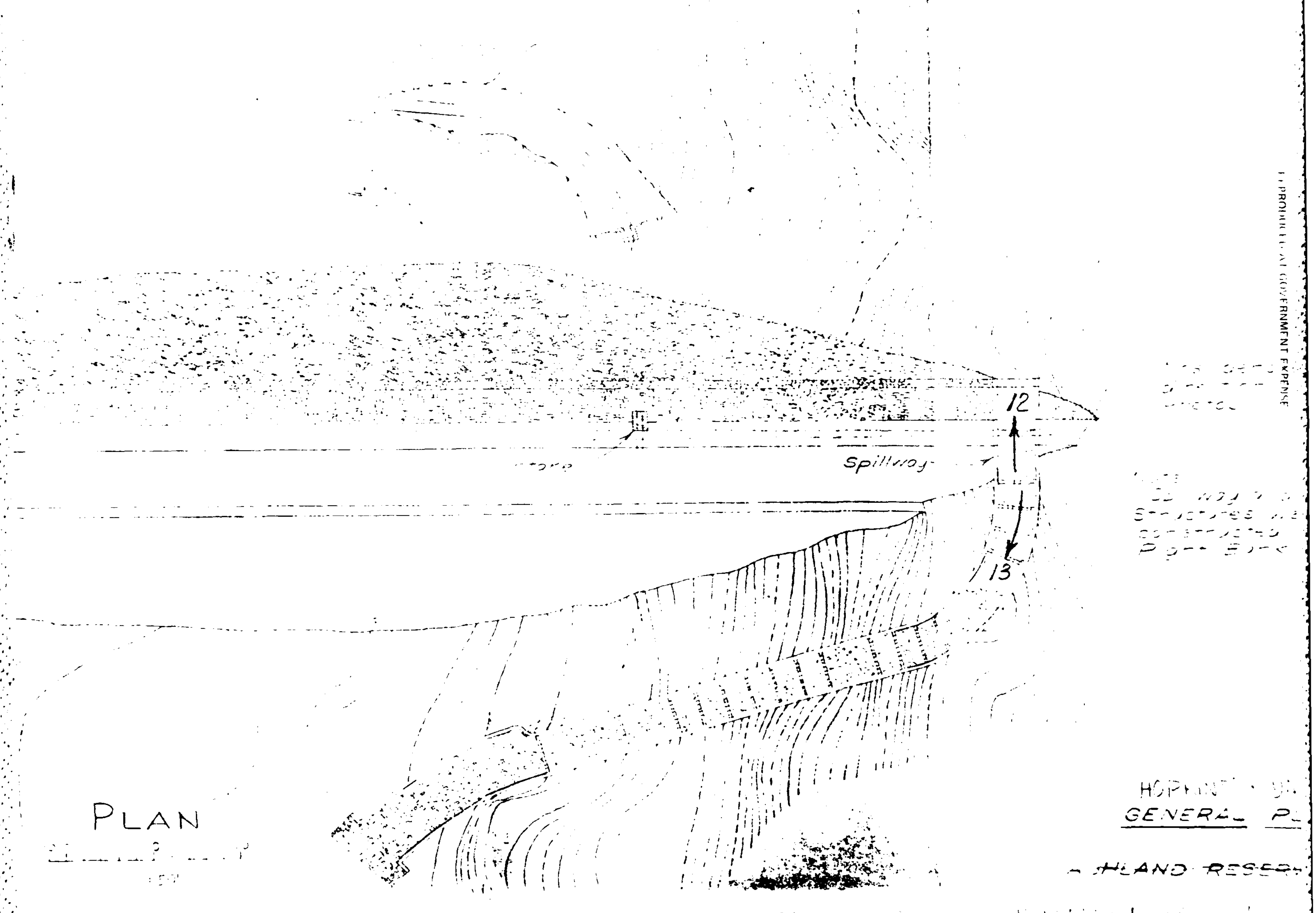
APPENDIX D

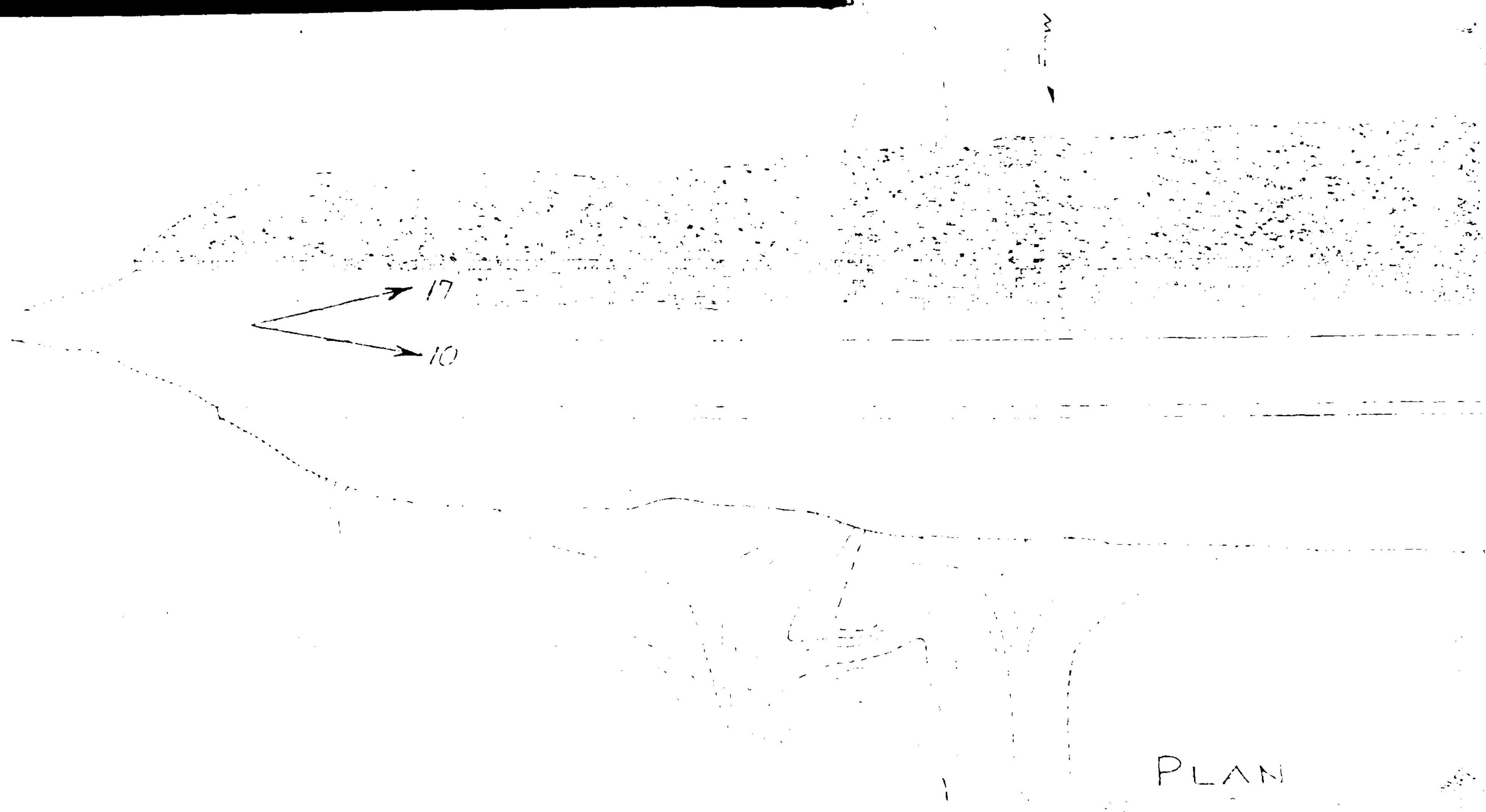


DAM SECTION

ASHLAND RESERVOIR

REPRODUCED AT GOVERNMENT EXPENSE





REPRODUCED AT GOVERNMENT EXPENSE

END

FILMED

7-85

DTIC